

WHAT IS CLAIMED IS:

1. A method of rearranging sub-codes of two-dimensional quasi-complimentary turbo codes (QCTCs), comprising the steps of:

- 5 generating sub-code sets of QCTCs with given code rates; and
rearranging sub-codes of a sub-code set with a same or different code rate that is to be transmitted after a sub-code with a predetermined code rate.

2. The method of claim 1, wherein the sub-code is a matrix with
10 elements representing puncturing and repetition.

3. The method of claim 1, wherein the rearranging step comprises the steps of:

- generating new sub-code sets, a matrix for each sub-code in each new sub-
15 code set having as many columns as the least common multiple of the numbers of columns of each sub-code in the sub-code sets; and

determining priority of the matrixes of sub-codes in each new sub-code set so that a matrix generated by combining matrixes from two of the new sub-code sets has a QCTC characteristic, and rearranging the matrixes in each new sub-code
20 according to the priority.

4. The method of claim 3, wherein the QCTC characteristic is that elements of the matrix have a uniform distribution of repetition and puncturing.

25 5. A method of rearranging matrixes of sub-codes of QCTCs, comprising the steps of:

- generating sub-code sets of QCTCs corresponding to a plurality of given

code rates, each sub-code of the sub-code set being a matrix with elements representing repetition and puncturing;

generating new sub-code sets, a matrix of each sub-code in a new sub-code set having as many columns as a least common multiple of the numbers of columns
5 of sub-codes in the sub-code sets;

determining priority of the matrixes of sub-codes in each new sub-code set so that a matrix generated by combining matrixes from two of the new sub-code sets has a QCTC characteristic; and

rearranging the matrixes in each new sub-code according to the priority.
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6. A method of transmitting symbols using sub-codes of two-dimensional QCTCs, comprising the steps of:

rearranging sub-codes in sub-code sets of QCTCs corresponding to a plurality of given code rates and storing the rearranged sub-codes;

15 selecting a QCTC with a code rate determined for transmission; and

transmitting symbols using a sub-code in the sub-code set of the selected QCTC.

7. The method of claim 6, wherein the rearranging step comprises the
20 steps of:

generating new sub-code sets, a matrix of each sub-code of the new sub-code set having as many columns as the least common multiple of numbers of the columns of each sub-codes in the sub-code sets;

determining priority of the matrixes of sub-codes in each new sub-code set
25 so that a matrix generated by combining matrixes from two of the new sub-code sets has a QCTC characteristic; and

rearranging the matrixes in each new sub-code according to the priority.

8. The method of claim 7, wherein the QCTC characteristic is that elements of a matrix have a uniform distribution of repetition and puncturing.

5 9. A method of generating sub-codes of two-dimensional QCTCs, comprising the steps of:

generating sub-codes of a QCTC with the highest code rate among QCTCs with code rates in an integer-multiple relation and setting the QCTC with the highest code rate as a primitive code;

10 determining a number of sub-codes to be grouped in the primitive code to generate each of the other QCTCs; and

generating sub-codes of the other QCTCs by grouping the sub-codes of the primitive code according to grouping numbers.

15 10. The method of claim 9, further comprising the step of transmitting a sub-code following a previously transmitted sub-code in a sub-code set of a QCTC with a code rate determined for transmission.

20 11. A method of transmitting symbols using sub-codes of two-dimensional QCTCs, comprising the steps of:

generating sub-codes of a QCTC with the highest code rate among QCTCs with code rates in an integer-multiple relation and setting the QCTC with the highest code rate as a primitive code;

25 determining a number of sub-codes to be grouped in the primitive code to generate each of the other QCTCs; and

generating a sub-code by grouping as many sub-codes of the primitive code as a grouping number corresponding to a determined code rate for transmission,

starting with a sub-code following a previously transmitted sub-code in the primitive code, and transmitting symbols using the generated sub-code.

12. A method of transmitting symbols using sub-codes of two-dimensional QCTCs, comprising the steps of:

generating sub-codes of a QCTC with the highest code rate among QCTCs with code rates in an integer-multiple relation and setting the QCTC with the highest code rate as a primitive code;

generating sub-codes of the other QCTCs by grouping the sub-codes of the primitive code;

determining a sequence number, j_{current} to be used in transmission by the following equation when a code rate for transmission is given

$$[((j_{\text{pre}}+1)*g_{\text{pre}} \bmod S_p)-1]+1=(j_{\text{current}}*g_{\text{current}}) \bmod S_p$$

where j_{pre} is a sequence number of sub-code used for the previous transmission, g_{pre} is a grouping number used for the previous transmission, g_{current} is a determined grouping number and S_p is a set size of the primitive code; and

transmitting symbols using a sub-code corresponding to the determined sequence number among sub-codes of the QCTC according to the determined code rate

13. A method of generating sub-codes of two-dimensional QCTCs, comprising the steps of:

grouping QCTCs according to code rates, each QCTC group including QCTCs with code rates in an integer-multiple relation;

generating sub-codes of a QCTC with the highest code rate in each QCTC group and setting the QCTC with the highest code rate as a primitive code;

determining a number of sub-codes to be grouped in the primitive code to generate each of the other QCTCs in each QCTC group; and

generating a sub-code by grouping as many sub-codes of the primitive code as a grouping number corresponding to a code rate.

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14. A method of transmitting symbols using sub-codes of two-dimensional QCTCs, comprising the steps of:

grouping QCTCs according to code rates, each QCTC group including QCTCs with code rates in an integer-multiple relation;

10 generating sub-codes of a QCTC with the highest code rate in each QCTC group and setting the QCTC with the highest code rate as a primitive code;

determining a number of sub-codes to be grouped in the primitive code to generate each of the other QCTCs in each QCTC group; and

15 generating a sub-code by grouping as many sub-codes of the primitive code as a grouping number corresponding to a determined code rate for transmission and transmitting symbols using the generated sub-code.

15. An apparatus for rearranging sub-codes of two-dimensional QCTCs, comprising:

20 a turbo encoder for encoding an input information bit stream with a predetermined code rate and generating code symbols;

a controller for rearranging sub-codes in sub-code sets of QCTCs corresponding to a plurality of given code rates and storing the rearranged sub-codes, selecting a QCTC with a code rate determined for transmission, and generating a
25 puncturing and repetition control signal for a matrix following a matrix used for a previous transmission among the rearranged matrixes of the selected QCTC; and

a QCTC generator for generating a sub-code to be transmitted by puncturing

and repeating the code symbols received from the turbo encoder according to the puncturing and repetition control signal.

16. The apparatus of claim 15, wherein the controller rearranges the
5 matrixes in each sub-code set so that a matrix produced by combining matrixes from two different sub-code sets has a QCTC characteristic.

17. The apparatus of claim 16, wherein the QCTC characteristic is that
10 elements of a matrix have a uniform distribution of repetition and puncturing.

18. An apparatus for transmitting symbols using sub-codes of two-dimensional QCTCs, comprising:

a turbo encoder for encoding an input information bit stream with a predetermined code rate and generating code symbols;

15 a controller for storing a set of matrixes from which to generate sub-codes of a QCTC with the highest code rate among QCTCs with code rates in an integer-multiple relation, setting the QCTC with the highest code rate as a primitive code, generating sub-codes of QCTCs by grouping the sub-codes of the primitive code, selecting a sub-code of QCTC according to the determined code rate when the code
20 rate for the transmission is given, and generating a puncturing and repetition control signal according to the selected sub-code ; and

a QCTC generator for generating a sub-code to be transmitted by puncturing and repeating the code symbols received from the turbo encoder according to the puncturing and repetition control signal.

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19. The apparatus of claim 18, wherein the controller selects a sub-code according to a sequence number, $j_current$, of sub-code determined by

$$[(j_{pre}+1)*g_{pre} \bmod S_p]-1]+1=(j_{current}*g_{current}) \bmod S_p$$

where , j_{pre} is a sequence number of a sub-code used in the previous transmission ,
 5 g_{pre} is a grouping number used for the previous transmission, $g_{current}$ is a
 determined grouping number and S_p is a set size of the primitive code.

20. The apparatus of claim 18, wherein the controller has a plurality of
 QCTC groups, each QCTC grouping having QCTCs with code rates in an integer-
 10 multiple relation.